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Report Type Evaluation and Certification

Report Date 5 June 2020

Issuing Laboratory GLI Europe B.V.

Evaluating Laboratory GLI Europe B.V.

Recipient ClusterTech International Inc
Ruđera Boškovića 13
78250, Laktaši
Bosnia and Herzegovina

Tested against Requirements GLI-11 - Gaming Devices in Casinos v3.0

Jurisdiction Non-Jurisdictional

Manufacturer ClusterTech International Inc
Ruđera Boškovića 13
78250, Laktaši
Bosnia and Herzegovina

Submitter ClusterTech International Inc
Ruđera Boškovića 13
78250, Laktaši
Bosnia and Herzegovina

Product Name Classic

Description of the Product Tested Classic (APX 517.1-10)
SD-GLI-200515.bin
As requested per submitter's letter received 31 March 2020.

Evaluation Period 1 April 2020 / 3 June 2020

Internal Reference RN-123-CLT-20-02

Result Pass (See Comments and Conditions on the following pages)

Internal methods used reference Random Number Generator (RNG) Analysis
WI-MA-006, PC-TC-001

Technical Evaluation authorized by:

Martin Britton
Managing Director





RANDOMNESS REPORT FOR THE CLASSIC DEVICE

The intent of this report is to indicate that **Gaming Laboratories International, LLC (GLI)** has completed its evaluation of the Classic physical randomness device, APX 517.1-10, provided by ClusterTech International Inc.

SECTION I- SCOPE OF TESTING

ClusterTech International Inc submitted the required materials to GLI in order to conduct a randomness analysis on the Classic device. The scope of this analysis was limited to device identification and data analysis. The device was tested for its ability to randomly produce outcomes for the Single-zero roulette game.

The Classic physical randomness device was evaluated against the RNG-specific requirements of the following technical standard:

- GLI-11 – Gaming Devices in Casinos v3.0

Please note, only one device was used for this evaluation. GLI does not test each device manufactured by ClusterTech International Inc and therefore does not attest to the randomness of each device on an individual basis. However, it is expected that each device is manufactured according to the same design and tolerances and should have similar randomness qualities as the device tested.

SECTION II - DEVICE IDENTIFICATION

Product ID: Classic APX

Model: Classic

Serial number: APX 517.1-10

The Classic software listed below is the program that controls the functionality of the Roulette and manages the draws.

File	Type	Signature
SD-GLI-200515.bin	Kobe4	556C
	MD5	ECFFCEF9517575411C206B685CA28E72
	SHA-1	45658E4A1A73FA1E4138D54A1CE6D3F549BFA20C
	Kobe40	9F0PA232176CHUCHH3HP789F0P696CAH18H84872
	CDCK	4AFA

Table 1. Digital Signatures





RANDOMNESS REPORT FOR THE CLASSIC DEVICE

SECTION II - DEVICE IDENTIFICATION (CONTINUED)

Changes of the hereafter listed device's critical subassemblies other than listed below, may affect randomness and in such a case this certificate is not valid:

Disc

- Subassembly description: Disc body with number and separator ring and metal cone.
- Allowed variations:
 - o Surface protection: nickel plating instead of tested gold plating.

Wooden bowl

- Subassembly description: Wooden bowl with ball launch channel, ball track and ball stoppers.
- Allowed variations:
 - o Wood
 - Materials: Black stained ash, padauk only, differently arranged padauk/ash stripes, wenge, MDF instead of tested padauk ash stripes.
 - Varnish: colored instead of transparent varnish.
 - Ball stoppers surface protection: nickel plating instead of gold plating.

Ball launch system

- Subassembly description: Starting block with sensors, tube towards wooden block.
- Allowed variations:
 - o Sensors: type of sensors for detection of the ball in the starting block.

Other non-critical product physical components may be changed and added under this certificate.

It is noted that any product variation result in the product model change in terms of added suffix and a complete product ID change.



RANDOMNESS REPORT FOR THE CLASSIC DEVICE

SECTION II - DEVICE IDENTIFICATION (CONTINUED)

The following is a picture of the Classic device as it was presented during GLI's inspection.



Picture 1. Classic physical randomness device



RANDOMNESS REPORT FOR THE CLASSIC DEVICE

SECTION III - DATA ANALYSIS

The Classic device automatically detects the ball and reports the extracted number. The settings used for the collection of the samples are listed in Table 2.

Game Parameter	Value
speed1Min	45
speed1Max	45
speed2Min	20
speed2Max	20
blowTimeMin	1,500
blowTimeMax	1,500
timeAfterWinMin	500
timeAfterWinMax	500
timeBeforBlowMin	100
timeBeforBlowMax	8,000
ludValueMin	800
ludValueMax	1,000

Table 2. Game Settings, time in milliseconds

The game configuration and parameters for the data obtained and tested are listed in Table 3. GLI performed a data format check on the data set listed in order to confirm that the game parameters were correctly represented in the data analyzed. A complete listing of the individual tests applied to each data set can be found in Appendix A.

Data Set	Range	Positions	Draws
Roulette	0-36	1	14,097

Table 3. Game Parameters

For a summary of the final outcome tests applied to each data set, see *Appendix A*. For a description of the overall test methodology and a description of each test used, see *Appendix B*.

Overall, the device passed the battery of tests for each configuration at the 95%, 98%, and 99% confidence levels. GLI makes no statement about the randomness qualities of the device if the recommended calibration and maintenance schedule is not followed.

SECTION IV – SUMMARY

Overall Evaluation of the Random Number Generator

GLI’s conclusion based upon the tests applied to the Classic data is that this physical randomness device has exhibited random behavior and is suitable for the applications as described herein. If a game utilizes a different range or a different number of selections from the included ranges, the device should be resubmitted to test that set of parameters.





APPENDIX A: Statistical Test Summary

Data Set	Range	Positions	Draws	Test Name					
				Runs	Serial Corr.	Duplicates	Overlaps	Tot. Dist.	Mechanical Roulette Test
Roulette	0-36	1	14,097	X	X	X	X	X	X

Table A 1. Tests Applied



APPENDIX B: Test Descriptions

B.1 Definitions. The following terms apply to the below test descriptions. Randomness Device or Random Number Generator (RNG) output may be collected multiple numbers at a time. Each set of numbers is called a draw. Each individual number has a particular order within the *draw*. This is referred to as the number *position*.

B.2 Distribution Comparisons. Many of the tests compare an observed numerical distribution with an expected distribution. Unless otherwise specified, this is done by means of a statistical chi-square goodness-of-fit test. The value chi-square is computed in the standard way. If k is a possible value, o_k is the observed count of that value, and e_k is the expected count:

$$\chi^2 = \sum_k \frac{(o_k - e_k)^2}{e_k}$$

In the case where expected counts are too small for accurate use of the above formula, values are 'binned' together to ensure an appropriate minimum expected count. The resultant value for chi-square is compared against the distribution for the appropriate number of degrees of freedom. Unusually high (distribution mismatch) or unusually low (insufficient randomness) chi-square values can be causes for data failure.

B.3 Meta-testing. Evaluation of groups of p -values may include a meta-test for extremity of high or low p -values, a meta-test for frequency of high or low p -values, and a meta-test for uniformity of p -values, as appropriate.

B.4 Confidence Level. The statistical tests conducted by GLI are done at a particular *confidence level*. Common confidence levels used include 95%, 98%, and 99%, depending on jurisdictional requirements, and intended use of the RNG. High confidence level testing has low risk of mistakenly failing a good RNG, but higher risk of passing a bad RNG. Lower confidence level testing has increased power of detecting bad RNGs, while also increasing the risk of false failures of good RNGs. Specifically, the confidence level represents the probability that an ideal source of randomness would pass the testing. If an RNG passes statistical tests at a given confidence level, passage at all *higher* confidence levels is implied.

B.5 Tests. Some tests are only applicable to certain types of data. Some tests may be applied only to a portion of the data. Some tests may require that the data be parsed, binned, or otherwise transformed, as necessitated by data format.



APPENDIX B: Test Descriptions

Duplicates:

The Duplicates Test counts the number of times a draw is exactly duplicated in the data. In the case that a particular draw is repeated more than twice, every possible way to generate a duplicate is counted. This is compared against the theoretical distribution to verify that the number of duplicate draws falls within expected bounds. For example, consider the dataset consisting of the following draws of two numbers each.

- a) 1, 3
- b) 4, 1
- c) 1, 3
- d) 1, 3
- e) 4, 1
- f) 3, 1

The duplicate pairs are (a, c), (a, d), (c, d), and (b, e), for a total of 4 duplicates. (f) is not counted as a duplicate since the draw must match in order as well as values.

Mechanical Roulette Suite:

The Mechanical Roulette Suite consists of several tests which are intended to be able to detect biases that may be present in a physical roulette wheel. These biases may result from imbalanced wheels or from manufacturing irregularities that cause a particular position to be more or less likely than expected. Included in this suite are tests on overall distribution, draw-to-draw independence, and directional drift over time.

Overlaps:

The Overlaps Test compares consecutive draws for overlapping values. The number of overlapping values is recorded for each pair of draws. This observed distribution of overlaps is then compared against the expected distribution. For example, if the following draws are observed consecutively,

- a) 1, 4, 5, 6
- b) 4, 1, 7, 6

the number of overlaps would be 3, representing the values 1, 4, and 6.

Runs:

The Wald-Wolfowitz Runs Test is applied to each position within the draw. A center is established, typically the data median, and the number of 'runs' above and below the center are tallied. Values exactly equal to the center are discarded. This is compared to the expected distribution, which depends on the number of values above and below the center. For example, if the numbers drawn at a particular position were

2, 3, 1, 5, 4, 7, 3, 2, 3, 2, 3, 2, 6, 7, 3, 5

and the established center were the data median of 3, the data would be parsed for runs above 3 and runs below 3.

2, 3, 1, 5, 4, 7, 3, 2, 3, 2, 3, 2, 6, 7, 3, 5

This would be counted as 4 runs.

Serial Correlation:

The Serial Correlation Test measures statistical correlation between consecutive draws of the same position. For each position, the sample Pearson correlation coefficient is calculated. If X represents the first number, and Y the number that follows, then the coefficient is

$$r = \frac{cov(X, Y)}{s_X s_Y}$$

where s denotes the sample standard deviation. The coefficients are used to generate a p-value for each position.





APPENDIX B: Test Descriptions

Total Distribution:

The Total Distribution Test is a simple tally of all observed values throughout the data. This is compared with the expected distribution. Typically, the expected distribution is a uniform distribution. In the case of unequal weighting of values, an appropriate discrete distribution is used.

